

Table of Contents -- Chapters 1-6

Chapter 1 -- Introduction.....	1
Background.....	1
Process and Bases for Establishment of Minimum Flows and Levels.....	2
Process Steps and Activities.....	2
Legal and Policy Bases for Establishment of Minimum Flows and Levels.....	3
Identify Relevant Water Resource Functions.....	3
Identify Considerations and Exclusions: Baseline Conditions to Protect Water Resource Functions.....	4
Level of Protection for Water Resource Functions Provided by the MFL Standard of <i>Significant Harm</i>	4
Other Levels of Harm Considered in Florida Statutes	6
Consumptive Use Permitting Role - Harm Standard.....	6
Water Shortage Role - Serious Harm Standard.....	6
MFL Recovery and Prevention Strategy.....	7
Document Structure	8
Chapter 2 -- Description of the Water Body.....	9
Introduction.....	9
Description of the Watershed.....	10
Climate, Rainfall and Seasonal Weather Patterns	10
Pre-Development Hydrology	13
Major Drainage Sub-Basins	13
Watershed Components	16
Northwest Fork of the Loxahatchee River and Upstream Watershed	16
Physical Features.....	16
Floodplain Plant Communities.....	16
Wild and Scenic River Designation	20
Tributary Inflows.....	21
Downstream Areas.....	21
Central Embayment.....	23
North Fork	23
Northwest Fork Estuary.....	24
Southwest Fork.....	25
The Loxahatchee Estuary.....	26
Physical Features	26
Inlet Configuration/Coastal Influences.....	26
Drainage Alterations	26
Shorelines.....	26
Sediments	27
Salinity	27
Biological Resources.....	28
Mangroves.....	28
Submerged Aquatic Vegetation.....	29
Oysters	31
Benthic Macrofauna	31
Fishes	33
Manatees	34
Estuary Water Quality.....	35
Salinity	35
Nutrients	35
Turbidity and Color	36
Oxygen and Temperature	36
Light	36
Pollutants.....	36
Sources of Water Quality Degradation.....	37

State Listing of Impaired Waters.....	37
Water Quality Initiatives	38
Adjacent Coastal Waters.....	38
Watershed Features and Alterations	39
Surface Water Hydrology	41
Surface Water and Ground Water Relationships	43
Major Aquifer Systems	43
Relationship between Ground Water and Surface Water Resources.....	44
Soils	45
Land Use	46
Water Supply	48
How Water is Allocated and Used:	48
Overview of Consumptive Uses within the Watershed:.....	50
Water Quality.....	52
Natural Systems	54
Major Plant Communities	54
Wetlands.....	56
Uplands	57
Estuary.....	58
Plants and Animals.....	58
Navigation and Recreation.....	61
Water Resource Issues -- Problems Identified.....	62
Surface Water Resources	62
Ground Water Resources	63
Habitat Management	64
Loxahatchee River Watershed Problem Matrix	65
Chapter 3 -- Resource Functions and Considerations.....	67
Water Resource Functions	67
Fish and Wildlife Habitat.....	68
Preservation of the River's Wild and Scenic Values	68
Drainage and Flood Protection	69
Water Supply	70
Recreation	74
Navigation.....	75
Historical and Archeological Values.....	75
Water Quality Improvement	76
Resource Protection Issues and Concerns.....	76
Considerations and Exclusions	78
Considerations.....	78
Natural Systems.....	78
Hydrology	78
Water Supply.....	79
Flood Protection	79
Water Quality	80
Navigation and Recreation	81
Exclusions.....	81
Chapter 4 -- Methods for Developing Minimum Flow Criteria.....	83
Methods Considered to Develop MFL Criteria	83
Methods Used	84
Establishing Geographic Locations along the River	84
Hydrologic and Hydrodynamic Methods.....	86
Review of Historical and Current Conditions	86
Development of a Hydrodynamic/Salinity Model.....	86
Documentation of Historic Water Use within the Loxahatchee Basin.....	90

Simulation of Consumptive Uses within the Loxahatchee Basin.....	90
Biological Methods.....	91
Literature Review.....	91
River Vegetation Surveys.....	91
Salinity and Water Level Methods.....	94
Soil Salinity Survey.....	94
Statistical Analyses of Relationships between River Flow and Salinity	95
Analysis of Floodplain Water Levels in the Upper NW Fork.....	95
Development of a River Vegetation/Salinity (SAVELOX) Model.....	95
Chapter 5 -- Proposed Minimum Flow Criteria (Results).....	99
Introduction.....	99
Results of Literature Review	101
Hydrologic and Salinity Conditions.....	105
Sources of Freshwater Inflow	105
Northwest Fork.....	105
North Fork.....	108
Southwest Fork.....	108
Salinity Conditions within the Northwest Fork.....	109
Historical Data	109
Soil Salinity Survey Results.....	110
Effects of Consumptive Uses.....	112
Effects of Water Uses on Flows in the Loxahatchee River:.....	113
Biological Results	115
Importance of the Freshwater Floodplain Swamp	115
The Effects of Salinity on Cypress Trees.....	116
Concepts to be Considered.....	117
Literature Review.....	118
Conclusions and Recommendations.....	119
River Vegetation Survey Results	119
Semi-quantitative Survey	119
Quantitative Survey.....	123
Vegetation Changes along the Northwest Fork Since 1985	127
Other Factors Considered that May Affect Vegetation Distribution.....	129
Effects of Freshwater Inflows on the Loxahatchee Estuary	130
Major Features of the Estuary	130
Effects of High Rates of Freshwater Discharge	130
Effects of Low Rates of Freshwater Discharge	131
Importance of Maintaining Low-Salinity Conditions.....	131
Proposed VEC for the Northwest Fork	131
Rationale for VEC Selection.....	131
Species Selected as Representative of the Proposed VEC	132
Summary.....	133
Application of Modeling Tools.....	134
Analysis of the Simulated Long-term Salinity Record	134
Exposure to Different Salinity Concentrations at Particular Locations.....	136
Duration and Frequency of Exposure.....	136
Effects of Flow from Lainhart Dam on Salinity Conditions in the River	137
Summary of Technical Results.....	140
Application of the River Vegetation/Salinity (SAVELOX) Model	141
SAVELOX Model Results.....	141
Development of Resource Protection Criteria.....	143
Definitions of No Harm, Stressed and Significant Harm.....	146
No Harm.....	146
Stressed	146
Significant Harm	147

Proposed Minimum Flow Criteria	147
Basis of Proposed Criteria.....	147
Technical Criteria.....	149
Effects of the Proposed MFL on Salinity Conditions in the Estuary.....	149
Estuary Resources that need Protection	149
Effects of the Proposed MFL on Estuarine Organisms	150
Effects of Proposed MFL on Floodplain Hydrology.....	150
Effects of the Proposed MFL on Navigation and Recreation.....	153
Chapter 6 -- MFL Recovery and Prevention Plan and Research Needs	155
Introduction and Overview	155
MFL Recovery and Prevention Strategy.....	155
Implementation Policies.....	155
Implementation Process	156
Management Targets.....	156
Phased Recovery Plan.....	158
Operational Protocols.....	159
Regulatory Components.....	159
Phased Recovery Plan.....	159
Phase 1 (2002)	159
Phase 2 - Five Years (2002 through 2006).....	160
Phase 3 - Five Years (2011-2014).....	161
Phase 4 - CERP (2002 through 2021)	161
Summary of Project Costs and Benefits.....	161
Water Delivery Benefits of Proposed Projects.....	162
Evaluate Options to Obtain Water from other Basins.....	163
Pal-Mar/Cypress Creek and Hobe Groves	163
Kitching Creek	163
1. Kitching Creek Water Quality Improvement Project	163
2. Kitching Creek East Tributary Diversion Berm	164
3. Flora Avenue Area Improvements	164
Operational Protocols	164
Interim Operating Procedures	164
Development of New Operational Protocols	165
Design and Operational Issues Suggested for Consideration by Concerned Citizens and Other Agencies	165
Regulatory Components of the MFL Recovery and Prevention Strategy	165
Consumptive Use Provisions/MFL	166
Water Shortage Plan Implementation	167
Restoration Components for the Northwest Fork.....	168
Water Reservations	168
Legal Description	168
Development and Implementation	169
Adaptive Management of the Loxahatchee River and Estuary.....	169
Research Needs.....	169
Monitoring Program.....	171
Adaptive Management Operational Strategy	173
Components.....	173
Benefits	173
Literature Cited	175
Glossary	182